REMARKS

Reconsideration of the above-identified application in view of the foregoing amendments and following remarks is respectfully requested.

A. Status of the Claims and Explanation of Amendments

Claims 36-44 are pending. Claims 36-37, 39-40 and 41-43 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,000,227 to Kroeker ("Kroeker") in view of U.S. Patent No. 5,813,233 to Okuda et al. ("Okuda") and U.S. Patent No. 6,298,669 to Maruyama et al. ("Maruyama"). Claims 38 and 44 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Kroeker in view of Okuda and Maruyama and further in view of U.S. Patent No. 6,098,408 to Levinson et al. ("Levinson").

By this paper, claim 36 is amended to recite, *inter alia,* a "controller for controlling temperature of said board by changing voltage applied to said Peltier element". Support for the amendment can be found throughout the application including, for example, numeral reference 300 in Figs. 1 and 3 with the associated text. In particular, a portion of the specification describes "[t]he cooling apparatus 1 includes, as shown in Fig. 1, a detector 100, a radiation cooling mechanism 200, and a controller 300" (Specification, p.11, line 1-3). Furthermore, it's described in the application that "[t]he 'Peltier effect' is a phenomenon in which the heat transfers due to a difference of electric conductivity when the current flows through two types of contacts of conductors or semiconductors... Electrons have a difficulty to flow on an area from the p-type semiconductor to the n-type semiconductor, forming a heat absorption surface 242, whereas electrons easily flow through an area from the n-type semiconductor to the p-type semiconductor, forming a heat radiation surface 244. Therefore, a joint of the heat absorption surface 242 of the Peltier element 240 with the radiation plate 210A

would absorb the heat from the radiation plate 210A and cool the radiation plate 210A. The heat value which the Peltier element 240 may absorb is adjustable by applied voltage." (Specification, p.22, line 21 to p. 23, line 10).

Claim 36 is also amended to recite a radiation block in the cooling apparatus, which is "connected to the heat radiation surface through the Peltier element, said radiation block having a channel to flow a coolant for cooling the heat radiation surface and being placed in a vacuum atmosphere". Support for the amendment can be found throughout the application including, for example, Fig. 3 with the associated text.

Furthermore, claim 36 is amended to recite "said cooling apparatus cools said optical element by controlling the temperature of said board and maintains a temperature of the coolant to a predetermined temperature". Support for the amendment can be found throughout the application including, for example, Figs. 2 to 6 with the associated text. In particular, since "[t]he mirror's surface shape changes by 0.1 nm as the temperature rises by 0.2° C" (Specification, p.3, lines 23-24), it's "[a]n exemplary object of the present invention to provide a cooling apparatus and method... which providing intended optical performance by reducing deformation of an optical element due to thermal expansion that would otherwise deteriorate image performance" (Specification, p 5, lines 3-11). Moreover, "[t]he Peltier element 240 has high responsiveness, precisely controls the temperature of the radiation plate 210A, and maintains the temperature of the optical element M to a predetermined value". (Specification, p.23, line 10-14).

Accordingly, no new matter has been added by this paper. The entry of the amendment is respectfully requested.

B. There is no suggestion or motivation to combine reference Kroeker and Okuda, because the wafer processing and cooling system in Kroeker is in vacuum atmosphere while Okuda requires air convection to function.

According to the outstanding Office Action, Kroeker discloses the basic inventive concept, a cooling system provided in a vacuum atmosphere comprising a radiational member 142 spaced apart from a rear surface of a wafer 162. However, Kroeker lacks other elements in claim 36, specifically a Peltier element connected to the board with a heating absorbing surface, and a radiation block connected to Peltier element and forming a circulation channel for flowing a coolant. References Okuda and Maruyama are then introduced to overcome the deficiencies, in which Okuda teaches a heat transfer system contacted to a head radiation surface to flow a coolant via a circulation channel. (07/06/2006 Office Action, p. 2-3)

However, a further review of Kroeker and Okuda suggests incompatibility with each other in view of the Applicant's application. Kroeker is directed to a wafer cooling system in a vacuum processing system, in which heated wafers are cooled inside the transfer chamber through a wafer lift assembly. The structure of Kroeker is shown below:

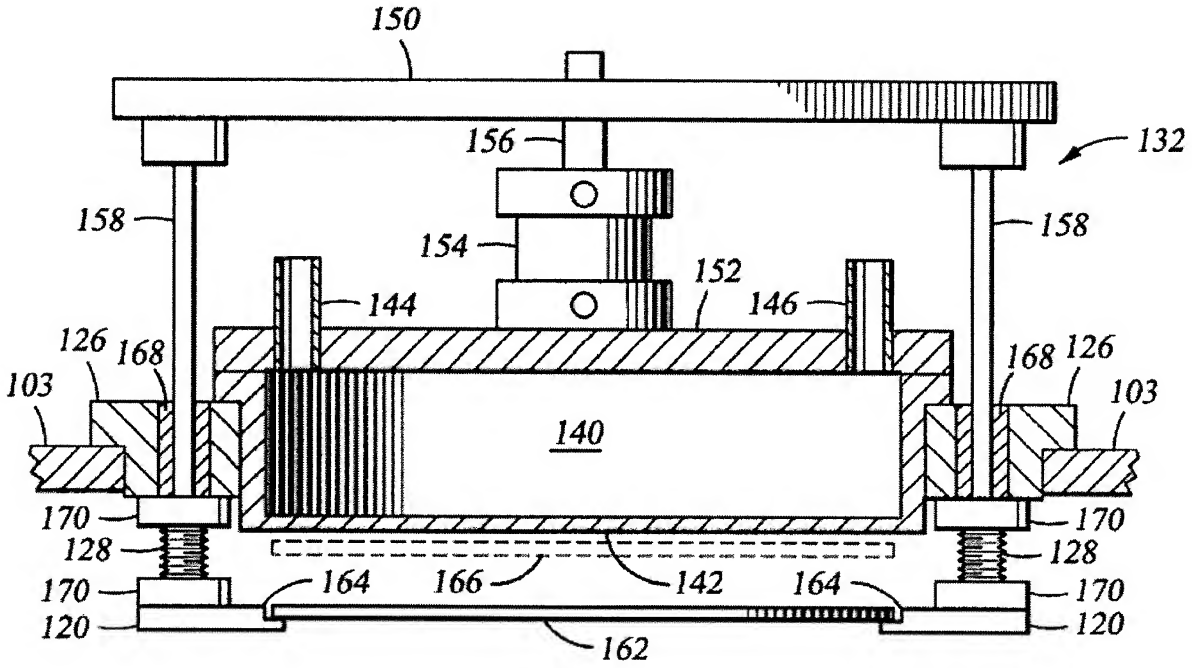


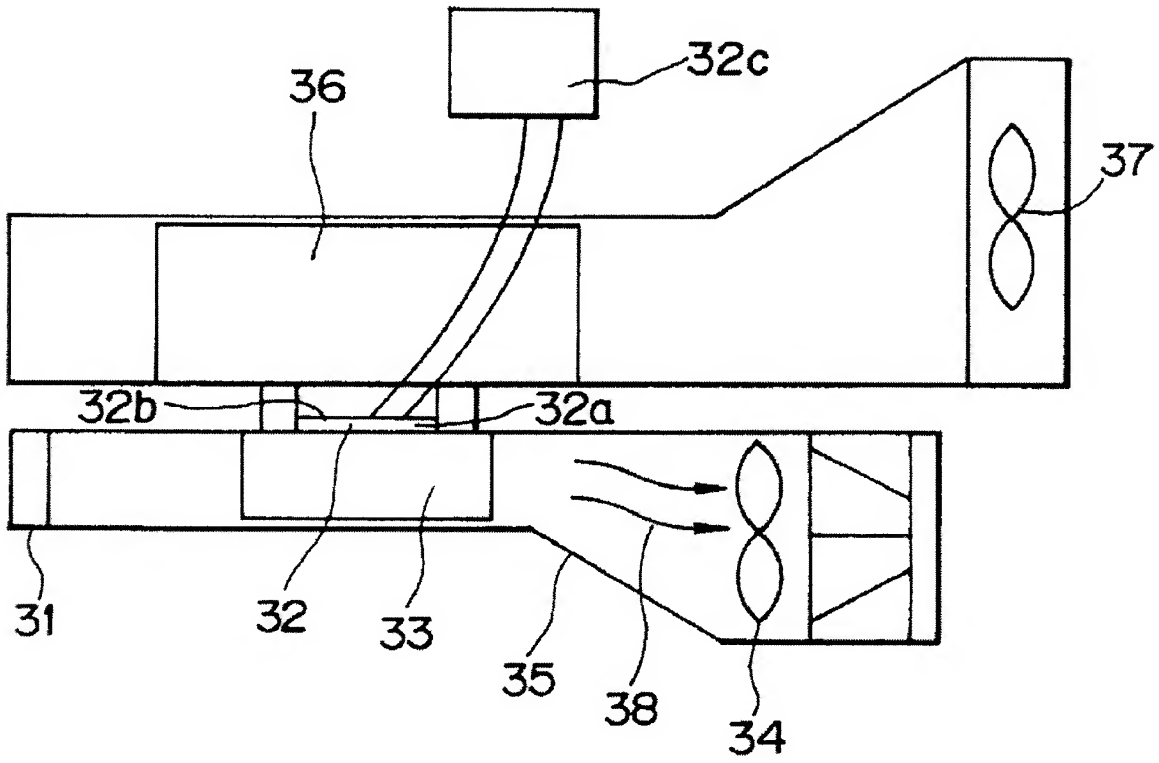
Fig. 7

According to Kroeker, heated wafer 162 is brought to the vacuum cooling chamber in Fig. 7. (Emphasis added). A wafer 166 is shown in dashed lines to demonstrate a wafer in the cooling position. The gap between the wafer 166 and the cooling plate 142 is about 20 mils during cooling in order to radiate the hear to the cooling plate 142. Water, or other coolant, circulates through tank 140 in order to remove the heat from the cooling plate 142. (Kroeker, col. 7, lines 12-22). Kroeker specifically states that "[s]ince the vacuum processing system is held at a vacuum, very little cooling is done by convection. Therefore, most of the cooling is done by radiation of heat to the cooler". (Kroeker, col. 5, lines 15-18).

Okuda is directed to a thermoelectric cooling device, wherein a thermoelectric module of a Peltier element is placed on a module base and a heat-absorbing fin member is fixed

to the base as a cold-side absorber and a radiating fin member is fixed to a module as a hot-side radiator.

FIG. 19



According to one of the embodiments of a thermoelectric cooling system of a liquid crystal projector taught in Okuda as illustrated above, a filter 31 disposed in the inlet port for the outside air is to prevent dust from entering and therefore adhering to a heat-absorbing fin unit 33. The outside air is drawn in through the filter 31 by a cooling fan 34 and is cooled by the heat-absorbing fin unit 33 as passing through a duct 35, thus providing cooled air 38. The heat-absorbing fin unit 33 is heat-conductively joined to a cold-side face 32a of a Peltier element 32, and the hot-side face 32b is heat-conductively jointed to a radiating fin unit 36 for radiating heat.

The heat radiated from the fin unit 36 is forcibly cooled and carried away by the drawn air by a radiating-side fan 37 to the outside. (Okuda, col. 14, line 62 to col. 15, line 12).

Therefore, since systems taught by Kroeker and Okuda require totally different conditions, it's almost impossible for an ordinary person in the related art to combine them together. The motivation asserted in the Office Action being to add heat transfer system contacted to a heat radiation surface to flow a coolant (The 07/06/2006 Office Action specifically pointed out that the cold air 38 functions as a coolant as it cooled down the liquid crystal panel 41 in 07/06/2006 Office Action, page 6) via a circulation channel as suggested in Okuda is not supported in Kroeker where wafer cooling device requires to operate in vacuum. In other words, there is no air coolant and air convection for heat-absorbing fin unit and hear-emitting radiating fin unit, and no actual heat transfer when applying Okuda's teaching in Kroeker. Therefore, it's respectfully asserted by the Applicant that the suggestion or motivation to combine Kroeker and Okuda is not convincingly established.

C. Claims 36-44 are Patentably distinct from the cited references.

The rejections of claims 36-44 are respectfully traversed in addition to the aforementioned argument for lack of suggestion or motivation for combining Kroeker and Okuda. As explained more fully below, in absence of Okuda, the remaining references, whether taken alone or in combination, fail to teach, disclose or suggest all the elements and limitation as recited in claim 36. In particular, neither Kroeker nor Maruyama teaches or suggests a controller to control the temperature of the board in order to control the temperature of the optical element and then to maintain the temperature of a coolant to a predetermined temperature.

Applicant's claim 36, as amended, recites:

Claim 36 An exposure apparatus for exposing a pattern onto an object, said exposure apparatus comprising:

an optical element provided in a vacuum atmosphere; and

a cooling apparatus for cooling the optical element using a radiation cooling,

wherein said cooling apparatus comprises:

a board arranged apart from the optical element, said board having a temperature that is smaller than a temperature of the optical element and being placed in a vacuum atmosphere close to said optical element;

a Peltier element having a heat absorption surface and a heat radiation surface, and connected to the board through the heat absorption surface;

a radiation block connected to the heat radiation surface through said Peltier element, said radiation block having a channel to flow a coolant for cooling the heat radiation surface and being placed in a vacuum atmosphere; and

a controller for controlling temperature of said board by changing voltage applied to said Peltier element;

wherein said cooling apparatus cools said optical element by controlling the temperature of said board and maintains a temperature of the coolant to a predetermined temperature.

As discussed above in Kroeker, a cooling plate 142 is engaged to cool down the wafer in a vacuum cooling chamber, in which heat is transferred to the wafer cooler for about 30 seconds or more, depending on the initial temperature of the wafer. (Kroeker, col. 5, lines 11-12). However, Kroeker is silent about engaging a controller to control the temperature of the cooling plate 142 and to maintain the temperature of the coolant.

Maruyama is directed to a pipe cooler and small-sized temperature controlling apparatus using a Peltier element as temperature adjustment unit. As shown in Fig. 7 of Maruyama, "[a] Peltier element 71 serving as a thermo module is fixedly brought in closed contact with a surface of heat exchange block 72 having a large heat capacity, which performs heat exchange with erosive fluid flowing in a flow path 74, and heat transferring means 73 is fixedly brought in close contact with a portion of the Peltier element 71 which is opposed to the heat exchange block 72, so that the erosive fluid is temperature-controlled to a target temperature by operation control of the Peltier element 71." (Maruyama, col. 1, lines 56-65). Maruyama

teaches using Peltier element as a temperature-controlling device to control the temperature of erosive fluid, however, Maruyama fails to teach a controller to control the temperature of an optical element by controlling the board, and fails to keep the temperature of the coolant to a predetermined temperature.

Therefore, claim 36, which recites "[c]ooling apparatus cools said optical element by controlling the temperature of said board and maintains a temperature of the coolant to a predetermined temperature", shall be patentably distinct from the cited references, whether taken alone or in combination.

Applicant has chosen in the interest of expediting prosecution of this patent application to distinguish the cited documents from the pending claims as set forth above. These statements should not be regarded in any way as admissions that the cited documents are, in fact, prior art.

Finally, Applicant has not specifically addressed the rejections of the dependent claims 37-44. Applicant respectfully submits that the independent claim 36, from which they depend, are in condition for allowance as set forth above. Accordingly, the dependent claims also are in condition for allowance. Applicant, however, reserves the right to address such rejections of the dependent claims in the future as appropriate.

CONCLUSION

For the above-stated reasons, this application is respectfully asserted to be in condition for allowance. An early and favorable examination on the merits is requested. In the event that a telephone conference would facilitate the examination of this application in any way, the Examiner is invited to contact the undersigned at the number provided.

THE COMMISSIONER IS HEREBY AUTHORIZED TO CHARGE ANY ADDITIONAL FEES WHICH MAY BE REQUIRED FOR THE TIMELY CONSIDERATION OF THIS AMENDMENT UNDER 37 C.F.R. §§ 1.16 AND 1.17, OR CREDIT ANY OVERPAYMENT TO DEPOSIT ACCOUNT NO. 13-4500, ORDER NO. 1232-5091.

Respectfully submitted,
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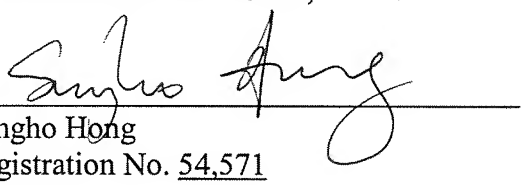
Dated: October 4, 2006 By: 

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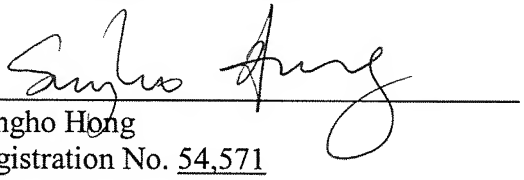
Dated: October 4, 2006 By: 

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